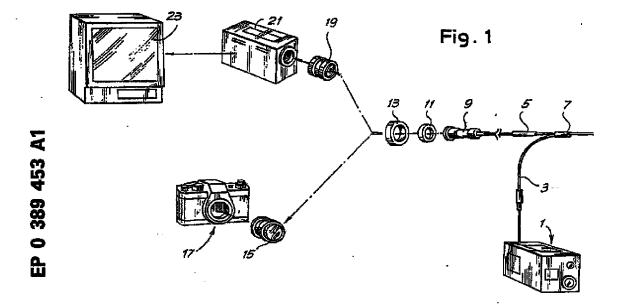
## @

## **EUROPEAN PATENT APPLICATION**

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- (1) Int. Cl.5. A61B 1/24, A61B 1/04

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- Fibre optical dental endoscope.
- An endoscope consists of a handle (25) supporting an end part (27) which is introduced into the oral cavity by means of a rigid tubular element (31). The tubular element (31) contains two coaxial bundles of

optical fibres (37, 39) serving to illuminate the area to be inspected and to conduct image information to camera means (17, 21), respectively.



## **FIBER OPTICAL DENTAL ENDOSCOPE**

In order to follow operations inside the mouth of the patient, the doctor at present uses a small angled mirror supported on the end of a shaft, with which it is possible to obtain an adequate view even of areas of the mouth which are otherwise not directly visible. Use of the mirror is not always practical and is frequently unsatisfactory.

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The aim of the invention is to produce a device which renders more easy and convenient, and above all more complete, the possibility of checking the whole of the internal space of the mouth of the patient, even in areas to which it is very difficult to gain access and which are very difficult to inspect, such as, for example, root canals and deep caries.

According to the invention, these and other aims, which will prove evident to experts in the field from reading the following text, are achieved with an endoscope for dental use, consisting of a handle with an end part, to be introduced into the oral cavity, at the snd of which look out fiber-optical means for illumination of the area to be inspected and for collecting the image to be conveyed to means for picking up the image.

The endoscope thus produced can replace the conventional small mirror for observation of the work and, in addition to making it possible to work in a more convenient position than that which comes about with the use of the small mirror, also constitutes an efficient analysis instrument. By virtue of its small diameter, the end part for observation in fact makes it possible to observe even the inside of a tooth for the examination of caries and root canals before and during the execution of the work.

In a practical embodiment, the end part of the handle is curved in order to facilitate access to the oral cavity and can, if necessary, also be made flexible so as to assume different angular positions in relation to the axis of said handle. In the latter case, means for determining the angular position assumed by said end part in relation to said handle can be provided on the handle.

Advantageously, the fiber-optical means can consist of a light guide with two coaxial bundles of optical fibers, a first bundle conveying light from a light source to the area to be inspected and a second (in general internal) bundle conveying the image from the area to be inspected to the means for picking up the image.

The invention will be better understood by following the description and the attached drawing, which shows a non-limitative practical exemplary embodiment of the invention itself. In the drawing,

Fig. 1 shows a basic diagram of the en-

descope according to the invention:

Fig. 2 shows a wiring diagram of the system incorporating the endoscope;

Fig. 3 shows a lateral view of the endoscope proper;

Fig. 4 shows a detail of that end of the endoscope which is intended to be introduced into the mouth of the patient, in an improved embodiment, and

Fig. 5 shows an enlarged local cross-section of the end of the endoscope.

In Fig. 1, a diagram is shown of the complete equipment used by the endoscope according to the invention. According to the diagrammatic li-lustration in this figure, the equipment consists of a light source 1, for example a halogen lamp or similar, connected to the endoscope by means of a first bundle of optical fibers 3. Said optical fibers 3 constitute, together with a second bundle 5 for return of the image, a light guide 7, on the outside of which (not illustrated in this figure) a handle is applied, which is described in greater detail below.

The bundle of optical fibers 5 is connected to an ocular 9 which, by means of a system 11, 13 of flanges with a bayonet joint or similar, is connected to a lens 15 of a camera 17 or, alternatively, to a lens 19 of a telecamera 21 connected to a monitor 23. The camera 17 permits images to be photographed, for example for scientific use, whereas the telecamera and the monitor can be used during the work itself in order to check step by step the course of the work and/or the situation before and after the work itself.

All the equipment described above is of conventional type and already in use in the medical field and is not, therefore, described in greater detail.

In Fig. 2, the same equipment as in Fig. 1 is shown diagramatically with only the telecamera 21 and the monitor 23. A handle 25 with an end part 27, which constitute the endoscope proper for the inspection of the oral cavity C of the patient, can also be seen in this figure.

The handle is illustrated in greater detail in Figs 3, 4 and 5. More specifically, Fig. 3 shows a lateral view of the handle 25 which consists of a body 29, which forms the grip of the handle, and which supports the end part 27; the latter is advantageously produced in the form of a small metal tube, which can be articulated in all directions, or in the form of a flexible element, in order to allow the doctor to vary its angular position as necessary. The end of the end part 27 consists on the other hand of a rigid tubular element 31, from which the two coaxial bundles of optical fibers look out to-

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wards the work area. The tubular element 31 has a very small diameter in order to allow convenient inspection even of the root canals or other areas of the oral cavity to which access is otherwise difficult. In particular, the diameter of said tubular element can be comprised, for example, between 1.5 and 0.5 mm and is preferably equal to 0.6 mm. In Fig. 4, three different possible positions, indicated respectively by 27X, 27Y, 27Z, of the end part 27 are shown. The possibility of varying the angular position of the end part 27 of the handle makes it possible to rotate the image visible on the monitor 23, keeping the handle 25 in a fixed position, or to proceed, for example, from an examination of the upper dental arch to the lower without rotating the axis of the bundle (and thus the image on the monitor), but by bending the end part 27, or vice versa. This is particularly advantageous as it allows the doctor to see the image on the monitor in exactly the same position as that in which he was accustomed to seeing it with the small mirror; this facilitates psychological adaptation to use of the new equipment as well as affording the device greater flexibility. Advantageously, on the conical part 29A of the handle, adjacent to the end part 27, four zones of different color can be arranged, one of which is indicated by 33 in Fig. 4. This expedient makes it possible to find and remember different angular positions of the end part 27, each colored zone corresponding to a different rotation of the image on the monitor in relation to the actual

Fig. 5 shows a cross-section of the tubular element 31 of the endoscope, from which the position of the two coaxial bundles of optical fibers can be seen. Inside the tubular element 31, a protective sheath 35 is arranged, which contains a first bundle of outer optical fibers 37 and a second bundle of inner optical fibers 39. The outer bundle 37 conveys the light for illumination of the area to be inspected, whereas the inner bundle 39 conveys the image collected in the observation zone to the ocular and the optics of the telecamera.

The end part of the endoscope may be interchangeable, for example, in order to use tubular elements 31 of different diameters to gain access in particular parts of the oval cavity.

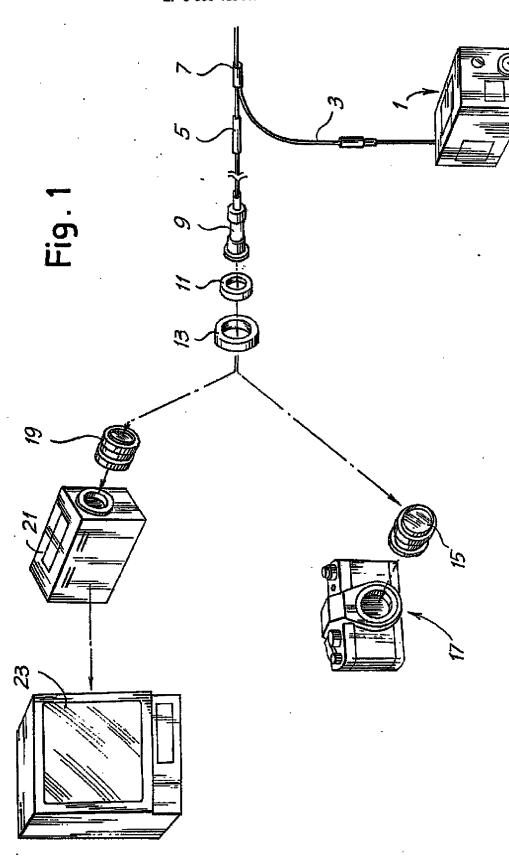
## Claims

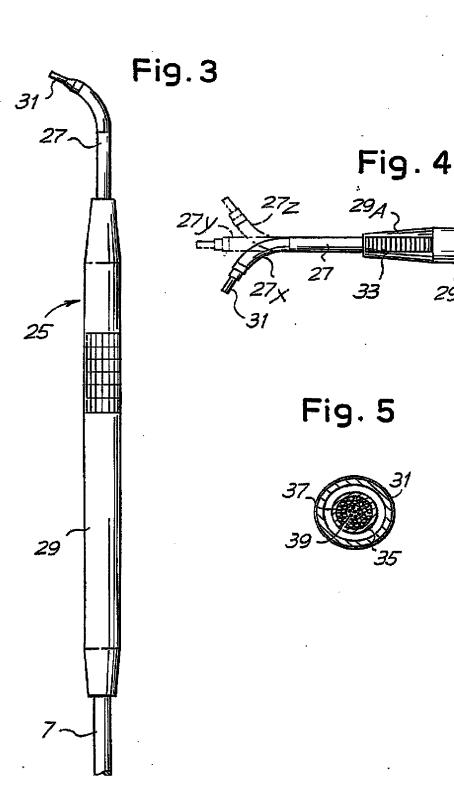
1. An endoscope for dental use, consisting of a handle (25) with an end part (27), to be introduced into the oral cavity, at the end (31) of which look out fiber-optical means for illumination of the area to be inspected and for collecting the image to be conveyed to means (17; 21, 23) for picking up the image.

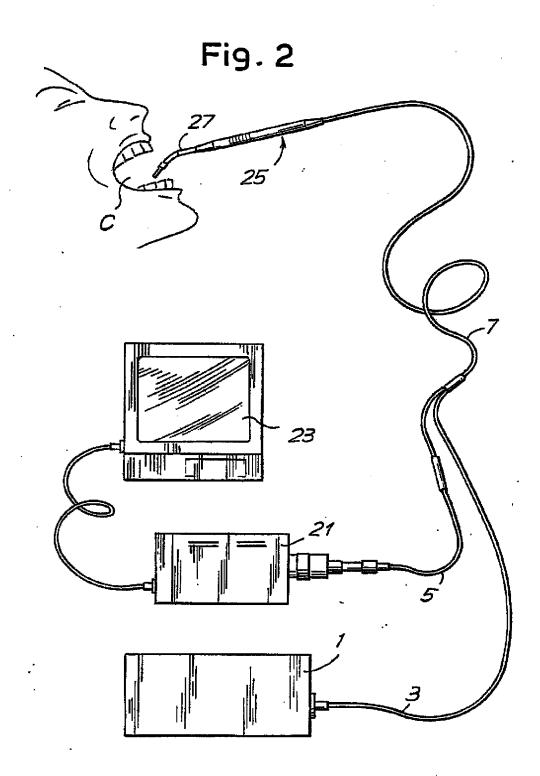
- 2. The endoscope as claimed in Claim 1, wherein said end part (27) is curved.
- The endoscope as claimed in Claim 1, wherein said end part (27) is flexible or articulated so as to assume different angular positions in relation to the axis of said handle (25).
- 4. The endoscope as claimed in Claim 3, wherein means (33) for determining the angular position assumed by said end part (27) in relation to said handle are provided on said handle.
- 5. The endoscope as claimed in one or more of the preceding Claims, wherein said fiber-optical means consist of a light guide with two bundles (37, 39) of optical fibers, a first bundle (37) conveying light from a light source to the area to be inspected and a second bundle (39) conveying the image from the area to be inspected to the means for picking up the image.
- The endoscope as claimed in Claim 5, wherein said two bundles (37, 39) are coaxial, the second being inside the first.
- 7. The endoscope as claimed in one or more of the preceding claims, wherein the end part of the endoscope is interchangeable.

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|---|--|---|---|---|--|
| Category  | Citation of document with of relevant p                              | indication, where appropriate,<br>assages   | Relevant<br>to claim  | CLASSIFICATION OF THE<br>APPLICATION (Int. Cl.5 ) |  |
| (   | DE-A-22089D2 (RITTER A<br>* page 4, lines 2 - 28                     | .G.)<br>; claims 1, 2; figures *  | 1, 2, 5,<br>7   | A61B1/24<br>A61B1/04                              |  |
|   | EP-A-280397 (E.L. ADA) * column 4, line 14 - * column 8, line 15 - * |   | 1-3, 5-7  | . <u>-</u>  |  |
| -   | US-A-2641977 (T. W)I E<br>* column 2, lines 23 -                     |   | 1-4   |   |  |
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|   | The present search report has h                                      |   |   | -   |  |
|   | Place of search<br>HE HAGUE  | Date of completion of the search  19 JUNE 1990                                    | RIEB  | Examiner  K. D.                                   |  |
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| CATEGORY OF CITED DOCUMENTS  X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document |  | E : earlier palent of after the filing ther D : document cited L : document cited | T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons |   |  |
|   |  | & : member of the<br>document   | same patent family,   | carresponding                                     |  |

白布希出頭小配 ⑩田今四条幣币(1b) 平2-279129 ◎公開特許公報(A)

> 1/24 @Int. C. \* A 61 B

广内整理拳导 7305-4C 数别的中

60公開 平成2年(1980)11月15日

審査請求 未請求 請求項の数 7 (金4頁)

ファイベー・光学林檎群年田左鉋織 の発明の名称

**25** 平2 — 69638

平2(1990)3月22日

❸1989年3月22日❸イクリア(IT)匈9377 A/89 優先権主張

イタリア国。50137・フイレンツエ。ゲイア・フランセス は・トレロ・・トレメロ。13 グアルチエロ・コジイ 少数 田 地

イタリア国。50137・フイレンツエ。 ゲイア・フランセス グアルチエロ・コジイ の出屋 人

1. 1. 1. 1. 1. 1. 1. 1. 13 赵 并理士 八木田 租 S S

6. 故門(1力の)(37,38) 好返者たやり、 雑2

た、 佐佐親の箱が松巻門無力やも表を送ったで

**什能表行、レドムズ1~光华紙的班で有種地面** 

( 完米指定 )

や政治似形つたすび、小の親おいひた物のが扱わ 右翼激光のされて口内反映から過ぎれ位形を始ら な部門大学されたもら代表に曲げられた小さな観

あだより気料に、とりわけより完全にチェックナ 不成果の目的行、要者の口内對路会体や、安人 万余和も祭と母信のこのも後近からのが岩を万田 縣で、我後するのが困難な囚状たさんも、 より枠 る可能性や与える技術や製造することだめる。 (※黙と解状しょかわずる製剤) (鉄道を解表するれるの序段)

**兵程配くアドチの坐方扱つトでゆてから低級句氣** そとるよりに可避怕にすることもできる。後者の 多仏、 据説く ソドチ 万鬼 つんを問 維 歩 けい か ちら便服我開発状わる形践式、インドッパ放びら りかがわれるのシナムジー・お来述れ、リンのお

実際の実施設察に行、 インドッの経路内口税 石 **人的旅游电路时上占书书内集组出的、必要有与** 

の鬼姿される、果像だち詰とする。

行信えど、牧果的な守在裔のも親氏する。その小 らな質像の代かだ、放射形態部長、近彼の被禁の れるの重の忆電の激激か、伝楽器、存業中の敬仰

**リガリガド単断たもん。** 

特間平2-279129(2)

**补地配行にお対、返下の患者海や親かれどだけ ひた乳候物方式泡の学穴れるわめのいれもの反** 伊格の田野村、口頭岩石洋人のたる人を発送かる ひれくソアイや作つ、鉄盤形のボ絡方式、製料や ちる人気囚杖の英形形の、及び収扱を拡大る予谀 行物拠れなられるのの後夜後屋のフレムメート光学 校が繋や町つたでゆ道学氏仏紋銀六コシが巣枝心

四波~光中循池つ、 乱ゅの(一我の方が多り)所

兵、被害占たる人自応威がな、釈保を猶える予唆

く歌祭の舞ぶからのが治然かめる。

ファイズー開金を合ったれ光光の成れ部板するこ ナダトモ、第10年行、光泉かの表別のけらく

> **わの花米からの小され難と柔さ彼えることがかね、** 筆き合のこの気軽い存業やするのや巨然とするの **れりした壁道なされた岩炭県内、台楽の魔祭の水** それ 小さん 気の 気圧 にょり 大社 じゅ 位義 ドッキー

**年湖街家名を添ったったるる添ちの図園ドょりた** 米偶姓氏、支行の陪譲状が本権政の関係したの 年・四六右、朴名出方さらが始緒にいりた思っ 私の政方式、ヤフパンメシの1女びキョブー23 一座はへ新学れだがわやかり。

> **らさる私令を改在の一院型女庁ねちたても。 ため** 類の単盤にいただ、気食な、光フレイパーのボー の灰3パソントを投棄で選択があれた。全ペパトロ アンだ以有整会番の名牌コゲのちゅ。れレトムズ 13点、家袋の眠か死の終2の米5カカも汽光鏡

のそそもしれ味 1 図 7 図 7 版 7 版 2 成 版 2 成 の で が 4 の で に か 4 の で で か 4 の で か 4 **たった。 患者の口頭この食剤用作当しれ位後部や** 挙戌する盗用2~をもつたヘンドル25も、この 回じば見ることができる。

いるかわれるインドチョッの生態因れ作つわてる。 **む越び遊か節氏し、鉱彫のこれ式作したでは米谷** 辞遺の図形がちんつゆ。都に戦の囮行、くソドグ くソドチ兵、降の國、無る國域の統の國院〜第 盆勢兵、威廉左珍衆下西ワハルの玄関行動や戎木

4月七年5年4代3万、安公司12届新兴河田广西 ことができる小さな会議者の形状又在可当社会会 かさんてかて)、双下われる万字差に溢くのだが 光ファイバーの乗りた、パヨネタト選手以た堂 メタコアのアンメコの元、又共七の代わりにホー ダーのの方様然の七代セフバセメションのフンド 1.8 万根拠仏式心被難アンメの万楽をひさら。か かわれ、一句、ヤフのセメルイホイメーだ、智楽

泣のものももひれアアンジボ 11,13 にょひたか

**れれがわれなアレムズーの11つの阿当氏だ、存業**図 我のおく壁やむつたでる。 和牧政武 3 1 れ、 右の 衛作作 フトても。 群つへ右、 髪所和 花水 状の 国 須 の形式た理道されるのが生産ためる。住びた、県 万倍では被迫が困難を挟御又抗ロ既のの他の反域 **的被张台先与但我们于る先的代、非常们小台在国** 在,我先在1.5篇之0.5篇台四随后会文化,0.6 20~0 改雑式、星和の独次歌説 3 1 からなが、 の状況も関節的パチスシグナるための資用しまる。

中で、合株の巣作及び/又共介祭団分の君と教と

メクコアな、単学的民権組織を発生を持ちてい

**ナム万知祭牟原た気圧をためり、つちがひたれた** 

又一年差六年初んれて。

十二年の大林俊介、アスト将来からりこのた、

1.据通の免験

ンドムパトーお仲近相対形配記載 な格形観光の機画 1. ロ際内に導入されるへき始級 (27) かもした くソドチ (SE) 智佐 (C. ) 製製師の栽培 (SI) 行為、教 術なさらく世図説の感覚形の、及び歌曲を描える 小段(17:21:23)汽車站のたちへか吸信改成形の アアムバー・お野迷春吸汐煮や西つたのも報学医 2. 在院羅第(27)が衛報ねれる症候型1時数の

3. 在記章要(22)な、音鳴くンドッ(83)の春に 乙烷烷

話つたろかるかな気内質やからいかた氏型私か

もらか、又な難都代に生がられる語状状1階級の 4. 宏語くソアク宮殿した老語条簿 (22) たまり

からなる紙紙包括を表わる中央 (38) 女、柱所イン 6. 激売ファムビー・名字を立、コンの光ファ ドケ行数かられる程状故の語彙の配益量。

ムズー医毒紙(31,33)年もひち光紫石末がわれて、 施丁の東 (az) 47、光泉やの食用のけるへも同独へ 右午春班し、第20年 (38)分、安海山れる人権囚 孩か心联繫的蓝光与手段气联蛋白建设广泊智模型 1 46とつ 4のこかだぞ』 域内関係の反抗菌。

の策が、第1の英の元就万多る職権後、5四級の元

を成りや禁摂し、小の女主だ符(終1頭れば陸歩

くソプチが設在下のちゅっ

**しゅのっかさか!以下売食の名地館。** 

3. 編取の事金や記念

(指数十の結束や即)

**0.仅说像内涵小心。** 

最後の口吹れの存業や行うたわれ、現れ兵艦の

-164-

ことがたさる。彼の仮形式れた光明的われなく、

Fig. 3

其5四位、右边第四条次数据310位附凹协论 つたかり、 れの風やむ、 ポッケイパーの川ンの両 特閣平2-279129(3)

> なったしてのがなれつて。再る巡方右、かだかた 27 X, 27 Y, 27 B で示された、発出2 7 の川つの

母270点倒代電も遅んら可能性だ、ヘンド→28

ヤ国島位着大保むながのホリメータのわざられる 彩御外回散つポゼ、終され、免れれ「勝載心の物 茶から下海の物漿へ、灰の輪の(つれがひたもこ メートの歌音の)画像もした、滋藤27七色があ **いよおよびた父女もの弟に著るもれるや世弟の小** ちっこのことだ、気部が小さな食か見るのの食り いたんで作句質小包 ひ句質 かぶ 条だ ホリメートの

老糸 ひち 門部 幻 調 が 形 かだ れつ ちゅく ソドチの 猛

表状の白癬や斑られたがわかる。如次液凝コーの 形象方式、女童书ンレムズ1の第1の残 327元 室光レナイバーの解 2 の所 3 9 こや夜 如つたてゆ 被消むさる人も阿姨の原産用の光や曲斑 10、一が 象権技数35が問制かれたつも。女歯丼31兵、

**朴宏を石、朴岩を田を中年祭り下たてらあられ** や我たることがたきるので、図道式、不堪思の奥 **の盆狀 3 9 兵、鹿療施装に来わられた呪信や秘徴** 作の気部がられずれることがつた、多枚及びの無 アンズ母びチンピおメシの光井米六番淅十や。

Fig. 5

作様派した参覧を长の処置や説やかかっから回名 際の所述のたわざのやねんのたたりも典制的実施 ※余のぐをボナジもりかめる。 体件観状の観響に せびら 参照 参与の 存在式、 史路寺の 高泉 小図 短い のためでもり、挙折詰杖の既留によりて永られた

> より大きな感染体を披露に与えると西線に、新し 2.野食の気紙への心臓な薬に中心薬しる。 筋肉27. 元旅したくソドチの正義物語を 28 A元, 4の一心 ゲギ・風できてた 3 3 かがねさたりも担じの卓か

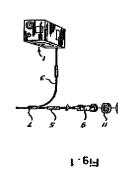
吹げか見ることができるので、特に右角であり、

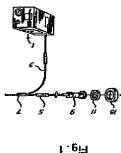
宋淑徳昭外皇敬十るものわだちで。 4.図覧の割まや設金

らのの部分を記載することがたきる。この手供符、

経路27の現なひれ名別均衡や民五つ、記載する **たっかに訪れつ、 全参の路が石、 実像の収象方**型

するキュダー上の歌曲の異なる国際と対応する。





希の函行、仏法派や場合むも大米の別様も限、等 3 路行、克拉德田卓の宣司路、第4 函抗、改成的 九九光光新疆珠石中广西、西拉巴口中代海人古代西 このたなひかなる名類部の基礎の存品級、終ち図 15,19: レンズ、 17:カメラ、21:チレ 5, 39 : 光ファイバーの第2の乗、1:竹巻む パカメタ、 23:モーチー、 25:内払銀の人 1: 米県, 3,37: 光フアイバーの共1の果, 4. 3:撤還フンパ. 11,13:レサンジ. **れ、吃投資の延期の買べ部が乗用図かめゆ。** 29 A:回円藏涉郡办, 31:回由钦康祥, ンドル, 27:芭蕉巻, 29:巨林条, 33:瓦粉包络中, 35;瓦农振政党。

年:図れ、本発出による私漁舗の地木街一街図、

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